There was no rain in connection with the hot squall, and none immediately preceding or following it. All regular and cooperative stations in southern Florida, however, reported rain on the 6th, the amounts being generally light. I have no means of ascertaining the time of occurrence of these rains. The sky at Miami during the early morning and the forenoon of the 6th was covered by St. Cu. clouds.

The sudden and phenomenal rise in temperature *must* have been caused by air that had been forced downward and heated adiabatically, but why the sudden and decided fall in pressure, instead of a rise, as occurs with the forward and downward rush of air from a thunderstorm? It is difficult to reconcile a strong descensional wind, such as must have occurred, with a simultaneously falling barometer.

The fall of pressure with this *hot* squall, however, corresponds to the rise in pressure attending *cold* squalls. I have never known the outrush of air from a thunderstorm to fail to lower the temperature, regardless of whether the storm was or was not attended by rain.—*R. W. Gray.*

## A HILLTOP FOEHN.

On the summit of Great Blue Hill (195 m. high) near Boston; Mass., May 6, 1913, immediately following a thunderstorm, in fact, three-quarters of an hour before the thunder ceased, a northwest wind of moderate force brought an almost instantaneous rise of temperature from 61° to 78° F., and an equally rapid fall in humidity from 100 per cent down to 20 per cent. These conditions persisted with minor interruptions (when temporary shifts of wind to the southwest put the temperature down 10° or so) for four hours, 10:20 p. m.–2:20 a. m. This extraordinary free-air foehn took place exactly in the center of a weak cyclone. At the base station, 118 meters below the summit of the hill, the maximum temperature was but 68°F.—*Charles F. Brooks.*

## RELATION OF CLOUDS TO WEATHER IN CENTRAL OHIO.

By HOWARD H. MARTIN, Observer.

[Dated: Weather Bureau, Columbus, Ohio, Aug. 25, 1919.]

SYNOPSIS.—It is the object of this paper to present as fully as possible the relation existing between the appearance of the various cloud forms and the subsequent changes in weather and temperature. To this end, a total of 5,037 observations at Columbus, Ohio, have been considered, covering a period of 10 years, 1909–1918, inclusive. A comparison of the prognostic values of cloud indications as observed at Columbus with those determined for San Francisco [1] will give the reader, at a glance, the salient differences existing between the marine and the continental types of climate, as shown by varying cloud forms.

*Cirrus.*—It is well known that cirrus attains the greatest altitude and the greatest velocity of all cloud forms. It has been regarded by tradition and adage as the first indication of approaching storm. With regard to this, Mr. Palmer says:

> Though cirrus and cirro-stratus clouds are apparently at times associated with anticyclones, they are typical accompaniments of cyclones. If a longitudinal section were made through the vertical axis of a typical cyclone and parallel to its direction of progression, the cirrus and cirro-stratus sheet forming the topmost portion would extend forward from the center a long distance and backward a shorter distance. In the sequence of events which usually precede cyclonic precipitation, clouds of this kind are ordinarily the first sign, often occurring many hours before the barometer begins to fall or before any other indication of the approaching storm makes its appearance.

TABLE 1.—*Weather conditions following cirrus clouds.*

| Clouds moving from— | Number of cases. | Precipitation followed— | | | Temperature changed within 24 hours. | | |
|---|---|---|---|---|---|---|---|
| | | Within 12 hours. | Within 24 hours. | Within 48 hours. | Less than 6°. | 6° or more warmer. | 6° or more colder. |
| April to September: | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* |
| N | 32 | 0 | 0 | 13 | 100 | 0 | 0 |
| NE | 23 | 0 | 52 | 54 | 46 | 54 | 0 |
| E | 2 | | | | | | |
| SE | 1 | | | | | | |
| S | 1 | | | | | | |
| SW | 14 | 0 | 0 | 0 | 22 | 0 | 78 |
| W | 94 | 12 | 45 | 56 | 53 | 23 | 24 |
| NW | 44 | 29 | 29 | 29 | 57 | 0 | 43 |
| For season | 211 | 12 | 33 | 46 | 56 | 18 | 26 |
| October to March: | | | | | | | |
| N | 12 | 0 | 0 | 83 | 25 | 75 | 0 |
| NE | 11 | | | | | | |
| E | 23 | 52 | 52 | 61 | 39 | 61 | 0 |
| SE | 11 | | | | | | |
| S | 12 | 0 | 0 | 0 | 25 | 0 | 75 |
| SW | 23 | 61 | 61 | 61 | 18 | 43 | 39 |
| W | 34 | 65 | 70 | 70 | 71 | 0 | 29 |
| NW | 64 | 18 | 52 | 70 | 22 | 78 | 0 |
| For season | 190 | 32 | 45 | 58 | 47 | 44 | 19 |
| For the year | 401 | 21 | 38 | 50 | 48 | 30 | 22 |

[1] A. H. Palmer, Clouds and their significance in local weather forecasting. MONTHLY WEATHER REVIEW, 1918, (46): 406–413.

Table 1 is a summary of the weather conditions following cirrus clouds observed at Columbus during the 10 years of observation. All cirrus clouds covering 0.1 or more of sky at time of observation are included in the table which embraces 401 cases. The weather following is computed in terms of the per cent of frequency of occurrence. As Mr. Palmer points out in his paper, high clouds can necessarily be observed only when unobscured by lower clouds, but it does not seem probable that, even were it possible to secure data of these clouds when so obscured, the final results would be altered to any extent.

It will be noted from Table 1 that cirrus clouds moving from a westerly or northwesterly direction are far more indicative of precipitation than from any other quadrants, excepting perhaps the northeast, where for a limited number of observations a rather high prognostic value was obtained, during the summer months, and from the north, during the winter months. Subsequent temperature changes exceeding 6° were more frequently positive during the winter months and negative during the summer, although for the year as a whole they were well divided. With the exception of movements from the directions noted above, cirrus was found to have a low prognostic value for Columbus. For a limited number of observations, (26) during the 10 years of cirrus moving at high velocity 76 per cent were followed by precipitation within 48 hours, whereas with no apparent movement 33 observations gave a prognostic value of only 26 per cent.

*Cirro-stratus.*—Table 2 reveals the fact that cirro-stratus, present at what might aptly be termed the secondary stage of cyclonic approach, is, when moving from a westerly direction, a rain prognostic of comparatively high value, especially during the winter months.

During these months, too, the appearance of such clouds is usually followed within 24 hours by a marked temperature change, exceeding 6°, a change of this character following 64 per cent of the 151 obsevations, regardless of cloud direction. When, during the winter, cirro-stratus approached from the southwest the value was considerably enhanced, 87 per cent of the 33 observations being followed by a pronounced change. During the summer months the changes were equably divided, with the negative slightly in excess, while during the winter the positive changes were predominant. When moving from a westerly direction, cirro-stratus may be relied upon to precede precipitation by 48 hours or less approximately seven times out of a possible 10, but when no direction is observed, its prognostic value is lessened to practically nil. Of 33 observations of this character, but one was followed by rain or snow within 48 hours. When the apparent velocity is greater than usual, the prognostic value is increased correspondingly. Of 57 observations at an unusual velocity, 88 per cent were followed by precipitation within 48 hours, regardless of direction.

TABLE 2.—*Weather conditions following cirro-stratus clouds.*

| Clouds moving from— | Number of cases. | Precipitation followed— | | | Temperature changed within 24 hours. | | |
|---|---|---|---|---|---|---|---|
| | | Within 12 hours. | Within 24 hours. | Within 48 hours. | Less than 6°. | 6° or more warmer. | 6° or more colder. |
| April to September: | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* |
| NE | 12 | 75 | 75 | 75 | ...... | ...... | ...... |
| E | 1 | ...... | ...... | ...... | ...... | ...... | ...... |
| SE | 38 | 26 | 78 | 78 | 83 | 17 | 0 |
| SW | 147 | 5 | 58 | 73 | 65 | 0 | 35 |
| W | 232 | 10 | 58 | 67 | 58 | 23 | 19 |
| NW | 130 | 16 | 48 | 48 | 44 | 40 | 16 |
| For the season | 560 | 13 | 58 | 61 | 58 | 21 | 21 |
| October to March: | | | | | | | |
| SW | 33 | 0 | 66 | 66 | 13 | 54 | 33 |
| W | 90 | 0 | 77 | 78 | 37 | 43 | 20 |
| NW | 28 | 0 | 93 | 93 | 64 | 0 | 36 |
| For season | 151 | 0 | 78 | 79 | 36 | 38 | 26 |
| For year | 711 | 10 | 61 | 64 | 54 | 24 | 22 |

*Alto-stratus.*—Table 3 presents the relation of the appearance of alto-stratus to subsequent meteorological conditions.

TABLE 3.—*Weather conditions following alto-stratus clouds.*

| Clouds moving from— | Number of cases. | Precipitation followed— | | | Temperature changed within 24 hours. | | |
|---|---|---|---|---|---|---|---|
| | | Within 12 hours. | Within 24 hours. | Within 48 hours. | Less than 6°. | 6° or more warmer. | 6° or more colder. |
| April to September: | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* |
| NE | 42 | 0 | 52 | 52 | 76 | 24 | 0 |
| E | 22 | 0 | 82 | 82 | 100 | 0 | 0 |
| SE | 33 | 30 | 30 | 68 | 70 | 30 | 0 |
| SW | 144 | 56 | 92 | 92 | 40 | 15 | 45 |
| W | 268 | 42 | 60 | 68 | 74 | 18 | 8 |
| NW | 152 | 20 | 38 | 38 | 72 | 6 | 22 |
| For season | 661 | 35 | 60 | 65 | 67 | 15 | 18 |
| October to March: | | | | | | | |
| N | 10 | ...... | ...... | ...... | ...... | ...... | ...... |
| NE | 10 | ...... | ...... | ...... | ...... | ...... | ...... |
| S | 9 | ...... | ...... | ...... | ...... | ...... | ...... |
| SW | 43 | 46 | 92 | 92 | 45 | 0 | 55 |
| W | 124 | 20 | 75 | 95 | 16 | 55 | 29 |
| NW | 51 | 0 | 46 | 50 | 40 | 60 | 0 |
| For season: | 247 | 17 | 66 | 79 | 36 | 41 | 23 |
| For year | 908 | 30 | 62 | 69 | 59 | 22 | 19 |

Of the alto-stratus cloud, Mr. Palmer says:

As indicated by its name, alto-stratus is a high stratiform cloud. Though not so high as cirro-stratus, it is usually much thicker and unlike the latter, it frequently is the source of considerable precipitatoin . . . In the usual sequence of events between the appearance of the first cirrus streamers and precipitation it marks an intermediate stage, most frequently following alto-cumulus and immediately preceding the lower clouds which give the precipitation. If a map were drawn to show the prevailing cloud visible in all parts of a typical cyclone, alto-stratus would form a broad ring nearly concentric with the isobars and immediately surrounding the area where rain was falling. This ring would be broad at the front and narrow at the rear.

It is especially to be noted from the table above that an unusually high prognostic value attaches itself to the movement of alto-stratus from the southwest during the summer months, while an even higher value is obtained during the winter months from the west and southwest. The movements of alto-stratus from an easterly direction was recorded at 97 observations, 62 per cent of which were followed by precipitation within 48 hours. This easterly movement, while unusual, accompanies the passage of a cyclone up the Atlantic coast and occurs during the winter months only.

Temperature changes in excess of 6° followed 64 per cent of the observations during the winter, regardless of direction, and when the cloud movement was from the west 84 per cent of the observations were so followed. The changes were positive during the winter and slightly negative during the summer, and were generally unimportant, only 41 per cent of all observations being so followed.

*Cirro-cumulus and Alto-cumulus.*—Since cirro-cumuli were recorded but a relatively few times during the period of 10 years in question, all observations of that cloud form were combined with those of alto-cumuli, the combined results being shown in Table 4.

TABLE 4.—*Weather conditions following cirro-cumulus and alto-cumulus clouds.*

| Clouds moving from— | Number of cases. | Precipitation followed— | | | Temperature changed within 24 hours. | | |
|---|---|---|---|---|---|---|---|
| | | Within 12 hours. | Within 24 hours. | Within 48 hours. | Less than 6°. | 6° or more warmer. | 6° or more colder. |
| April to September: | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* |
| SE | 14 | 0 | 70 | 70 | 34 | 66 | 0 |
| SW | 92 | 43 | 65 | 79 | 65 | 11 | 24 |
| W | 64 | 16 | 35 | 51 | 100 | 0 | 0 |
| NW | 40 | 50 | 74 | 74 | 100 | 0 | 0 |
| For the season | 210 | 35 | 62 | 74 | 79 | 10 | 11 |
| October to March: | | | | | | | |
| SW | 71 | 14 | 76 | 92 | 29 | 28 | 43 |
| W | 134 | 26 | 76 | 98 | 16 | 34 | 50 |
| NW | 90 | 23 | 60 | 74 | 16 | 60 | 24 |
| For the season | 295 | 22 | 69 | 89 | 20 | 40 | 40 |
| For the year | 505 | 26 | 65 | 82 | 45 | 27 | 28 |

As a rain prognostic, alto-cumulus from a westerly direction holds a high percentage during the winter months, 85 per cent of such observations being followed by precipitation within 48 hours.

Temperature changes exceeding 6° followed 79 per cent of all observations during the winter months, movements from the west and southwest being favored with a percentage of 84 per cent. The changes were equally divided between positive and negative during the winter, and bore a slight excess to positive during the summer, but, on the whole, were unimportant, with the exceptions previously noted.

Table 5 shows that the observation of cumulus was confined to the summer months, but 18 instances of winter cumuli being noted.

Of cumulus clouds, Palmer says:

True cumulus clouds are more often associated with the borders of the cyclone than with its center. * * * In certain places * * * cumulus clouds are a daily occurrence, due partly to excessive local heating and partly to the absence of strong horizontal movement. Whenever observed, cumulus clouds are of particular interest because of the information they give concerning the wind velocity aloft. Though the base of a cumulus cloud is ordinarily found in a region of comparatively calm air, the summit of the cloud often extends into a region of comparatively calm air, the summit of the cloud often extends into a region of swiftly moving air. Under these conditions the cloud leans forward. Sometimes the increase in wind velocity with increase of height is so rapid that the cloud "loses its head"; that is, the top portion is detached from and blown in advance of its base.

TABLE 5.—*Weather conditions following cumulus clouds.*

| Clouds moving from— | Number of cases. | Precipitation followed— | | | Temperature changed within 24 hours. | | |
|---|---|---|---|---|---|---|---|
| | | Within 12 hours. | Within 24 hours. | Within 48 hours. | Less than 6°. | 6° or more warmer. | 6° or more colder. |
| April to September: | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* |
| N | 11 | | | | | | |
| SW | 42 | 71 | 97 | 97 | 52 | 0 | 48 |
| W | 102 | 41 | 60 | 70 | 68 | 10 | 22 |
| NW | 40 | 81 | 81 | 81 | 75 | 25 | 0 |
| For the season | 195 | 52 | 68 | 74 | 69 | 10 | 21 |
| October to March: | | | | | | | |
| E | 9 | | | | | | |
| W | 9 | | | | | | |
| For the Season | 18 | | | | | | |
| For the Year | 213 | | | | | | |

The presence of true cumulus is apparently an excellent rain prognostic, especially when the movement is from the southwest, 97 per cent of such observations being followed by rain within 24 hours. All directions considered, it bears probably the highest prognostic value of any cloud form hitherto discussed. Its relation to temperature is apparently unimportant, a change of 6° or more following but 31 per cent of the observations.

*Strato-cumulus.*—Of the strato-cumulus, Palmer says in part:

> Formed only at low levels, its constituent particles are usually in liquid form, though the combination of two or more particles [of moisture] may produce snowflakes when the temperature is sufficiently low. Of itself, this cloud does not give heavy or widespread precipitation. Throughout most of the United States it gives only light showers in summer and snow flurries in winter. However, it is closely associated with the true nimbus cloud of the typical cyclone and is usually the last cloud observed immediately before and the first cloud seen immediately after long-continued precipitation.

TABLE 6.—*Weather conditions following strato-cumulus clouds.*

| Clouds moving from— | Number of cases. | Precipitation followed— | | | Temperature changed within 24 hours. | | |
|---|---|---|---|---|---|---|---|
| | | Within 12 hours. | Within 24 hours. | Within 48 hours. | Less than 6°. | 6° or more warmer. | 6° or more colder. |
| April to September: | | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* | *Per ct.* |
| N | 82 | 15 | 42 | 42 | | 28 | 14 |
| NE | 33 | 0 | 0 | 0 | | | |
| E | 14 | 0 | 0 | 0 | | | |
| SE | 103 | 70 | 89 | 89 | 80 | 20 | 0 |
| S | 20 | 90 | 90 | 90 | 30 | 0 | 70 |
| SW | 232 | 66 | 87 | 87 | 51 | 4 | 45 |
| W | 309 | 33 | 55 | 61 | 63 | 6 | 31 |
| NW | 208 | 31 | 51 | 57 | 57 | 16 | 27 |
| For season | 1,001 | 44 | 64 | 68 | 59 | 11 | 30 |
| October to March: | | | | | | | |
| N | 33 | 37 | 37 | 97 | 67 | 33 | 0 |
| NE | 11 | 0 | 0 | 92 | 23 | 0 | 77 |
| E | 12 | 75 | 75 | 75 | 30 | 0 | 70 |
| SE | 23 | 49 | 52 | 56 | 100 | 0 | 0 |
| S | 34 | 90 | 90 | 93 | 8 | 0 | 92 |
| SW | 182 | 67 | 91 | 93 | 12 | 20 | 68 |
| W | 190 | 43 | 58 | 81 | 42 | 21 | 37 |
| NW | 148 | 36 | 44 | 60 | 37 | 28 | 35 |
| For season | 633 | 49 | 62 | 78 | 35 | 20 | 45 |
| For the year | 1,634 | 45 | 62 | 70 | 51 | 14 | 35 |

Of all the cloud forms observed at Columbus, strato-cumulus has been observed with the greatest degree of frequency, 1,634 observations having been made in 10 years. Of this number, it was observed 1,001 times in summer and 633 times in winter. When moving from the southwest, it has a high prognostic value, being followed by precipitation within 48 hours 87 per cent of times observed during the summer and 93 per cent during the winter. For a limited number of observations, movement from the south may be considered of fairly high prognostic value, also.

It is to be noted that when the cloud movement is southwest a negative temperature change follows its appearance within 24 hours, during the summer months, 45 per cent of times observed. In the winter, under the same conditions, this negative change occurs with even greater frequency, 68 per cent of the observations being so followed. Temperature changes following the appearance of strato-cumulus lean perceptibly toward the negative: 582 of the 818 observations followed by any change preceded temperature falls in excess of 6°.

As has been pointed out by Palmer—

> Certain kinds of clouds are almost invariably associated with certain kinds of weather, and at times when the distribution of barometric pressure and temperature and wind velocities and directions are such as to create doubt in the mind of the forecaster, the kind and amount of clouds, and the direction in which they are moving will help him to decide upon the proper forecast to issue.

This is brought out very forcibly by glancing back over the tables and ascertaining the kind and direction of certain clouds most frequently associated with subsequent precipitation. For instance, during the winter months, the presence of alto-stratus moving from a southwesterly direction could be considered a reliable rain prognostic, since 92 per cent of all observations of movement from that direction were followed by precipitation within 24 hours; alto-cumulus from a westerly point, 98 per cent of such observations being followed by rain within 48 hours; cumulus from the southwest during the summer months, 97 per cent of such observations preceding rainfall by 24 hours or less; and strato-cumulus from the southwest at any time of the year, 89 per cent of such observations occurring within 24 hours of precipitation. It is probable that the direction of the surface wind bears an important relation to precipitation, but at this time no study has been given to this subject. It is obviously true, however, that movement from the southwest appears to be most frequently associated with subsequent precipitation with practically all cloud forms, and especially so with the lower clouds.

Palmer has found that in San Francisco the significance of cloud appearance increases as the height of the cloud decreases; that this significance varies greatly with direction; that for the higher clouds those moving from the southwest are most frequently followed by rain; that for the intermediate levels, those from the south are so followed; while for the lowest levels southeast is the direction of greatest significance.

In comparison, it may be said that in Ohio this significance also varies greatly with direction; that for the higher clouds, those moving from the west are most frequently followed by rain; that for the intermediate levels, those from the southwest are so followed; while for the lowest levels, southwest and south are the directions of greatest significance.

There appears to exist no doubt that clouds are a most important factor in practical weather forecasting, and too much stress can not be laid upon their most careful observation, the direction being an element too often ignored by hasty or careless observers. In smoky cities, and on dark mornings, it is especially difficult to ascertain either the direction or kind of cloud, and many observers hazard a guess rather than wait to determine the true classification, yet it should be remembered that observations of this character are often of less value than no observation at all and from a scientific standpoint are vicious in the extreme. Every careful, conscientious cloud observation and every well-determined direction of cloud movement is a distinct contribution to science and in this is its own reward.

## FROST CONTROL AND RELATED FACTORS.

By J. C. Whitten, Professor of Pomology, University of California.

[Dated: February, 1919.]

Heretofore we have thought of protecting plants from cold only by direct methods, such as covering or sheltering the plants or by orchard heating, to raise the temperature of the surrounding atmosphere. This conception was based upon the accepted belief that a given kind of plant inherits a given degree of hardiness; that there is a "critical temperature," above which the plant will live without injury and below which the plant will be injured or even die. Certain kinds of plants are notably hardy or resistant to injury from cold. Others are notably tender and subject to injury even in relatively mild climates.

We now know that while the above factors are true, in part, they do not explain the whole truth in determining the resistance of a plant to cold or to drought or to heat or to any other environmental influence that may favor or oppose the health and safety of the plant. To emphasize this statement we only need to call attention to the fact that a given variety of fruit trees may safely endure low winter temperatures while it is dormant or at rest; that it may be injured by a mere frost after it has started growth in spring; and that a sudden frost may kill it after it has gotten into the accelerated growth of the warmer summer.

The state or condition of a plant at a given time, its degree of ripeness and rest, or its degree of activity and growth governs largely how much cold or other unfavorable influence the tree may safely endure.

Studies made at the Missouri Experiment Station show that normally the sap of a fruit tree is least concentrated (contains the least sugar and digested plant food) during the period of rapid length growth in spring and early summer. Sap becomes more and more concentrated after length growth ceases. The supply of plant food reserves becomes greatest as the tree goes into winter condition.

The earlier a tree finishes its length growth the more concentrated its sap becomes and the more abundant its supply of plant food reserves. The more concentrated its sap the more cold the tree will stand either in winter or during spring frosts. In one plot, peach trees which had continued rank length growth until frost in autumn had all their flowers killed on a night the following spring at a temperature of 27°. The following night the temperature dropped to 22°. An adjoining plot of trees, which ceased length growth early, but which maintained healthy mature leaves until frost, endured this lower temperature safely without injury to their blossoms.

The merits of the new system of pruning, now being advocated, are better understood in the light of the above facts. The prominent feature of the former standard system of pruning is that the trees are severely headed back each winter. As a result, rank new growth is stimulated at the top of the cut-back branches. This rank, tender growth continues to lengthen and to make new leaves throughout practically the entire summer. This prevents early storage of plant food reserves and concentration of sap in the tree.

In the new system of pruning, the main limbs are established as early as possible. Once they are established they are not subsequently headed back. They are pruned by thinning out surplus limbs. Length growth ceases early. The tree early attains a concentrated sap and stores plant food reserves. These slow-growing limbs and leaves become firm in texture and evaporate but little water. There is no rank succulent upper limbs to rob or shade out the parts below. The leaves are not likely to draw water out of the fruit in time of drought. The concentrated sap gives up its water less readily. Such trees will endure more spring frost or more drought, due to their better ripened or perfected tissue and their more concentrated sap.

Judicious summer pruning consists of the removal of any surplus tender, succulent water sprouts that are growing where they are not wanted. Any permanent limbs that are continuing length growth too late may be checked in their growth by clipping them back. Dead, broken, or diseased parts should be removed.

So long as trees can secure ample water to supply their leaves, it is not desirable to reduce the leaf surface more than to check length growth of late-growing limbs. If drought is severe and trees are evaporating more water than can be supplied, evaporating surface may be reduced by judiciously removing the more tender, succulent parts, which are least needed as permanent limbs of the tree. Tender, soft, new leaves evaporate many times more water than older, firmer leaves that formed early in the season. The older, firmer leaves, if healthy, and which take on a dark green color, are more serviceable in the elaboration of plant food reserves.

### WHITEWASH THE TRUNKS OF YOUNG TREES TO PREVENT SUN SCALD.

The trunks of young trees should be whitewashed as soon as they are planted in the orchard to prevent sun scald and the drying out of the buds and growing layer. Whitewashing the trunks of young trees should be kept up each winter for the first three to five years after the young trees are planted. Exposed trunks or bare main limbs of older trees are also protected from sun scald if kept whitewashed.

Sunscald is most severe in winter, even though the injury may not be noticeable until summer. The coloring matter in the bark of trees absorbs heat enough from the sun's rays on sunny days to raise the temperature of the growing layer to from 15° to 25° (F.) above the temperature of the air. This renders the cells of the growing layer and buds, especially on the sunny side of the tree, turgid, active, and tender.

As the sun goes down at night, the temperature of the tree falls promptly to the temperature of the air, which may be to freezing or even below. This wide fluctuation of temperature between day and night injures the growing layer and buds.